A RAND NOTE

Measuring Physician Practice Patterns with Medicare Data

Sally Trude, Grace M. Carter, Carolinda Douglass

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PREFACE

Many studies of physician reimbursement ascribe unexplainable variation in costs and utilization to variation in physician practice patterns. This study explores the usefulness of linking information for a sample of physicians to hospital claims to address questions relating to individual practice patterns and the impact of payment policies on individual physicians.

This Note describes results from a project of the RAND/UCLA/Harvard Center for Health Care Financing Policy Research, which was supported by cooperative agreement 99-C-98489/9-08 between the center and the Health Care Financing Administration (HCFA). This Note will be of interest to those studying and formulating policy concerning Medicare reimbursement and individual physician practice patterns.

SUMMARY

With the implementation of Medicare's new payment system for physicians, debate about physicians' potential behavioral responses to that system has intensified. Such discussions have further highlighted how little is known about the practice styles and patterns of physicians. In addition, many analyses using a random sample of Medicare beneficiaries must often attribute unexplainable variation to physician practice style.

This study explored the feasibility and potential usefulness of physician-level analyses to investigate the importance of individual physician practice patterns. Specifically, this study used physician-level analyses to study three areas:

- The role of physicians in costly cases;
- Surgeons' practice of postoperative billing; and
- General and family practitioners' billing as assistants at surgery.

In the analysis of physicians' role in costly cases, we attempted to determine how frequently we could identify individual physicians (or practices) who frequently care for Medicare patients who are very expensive compared with the average Medicare case in the same Diagnosis-Related Group (DRG). We could identify individual physicians who frequently care for a substantial fraction of very expensive cases in only one of the six surgical groups (transurethral prostatectomy, TURP), for two reasons. First, many surgeons perform too few surgeries on Medicare patients in any set of DRGs with clinically similar surgeries, which precludes identifying a pattern of expensive cases not attributable to chance alone. Second, the surgeons' volume was significantly and negatively related to the likelihood that a case was very expensive. That is, surgeons who had a large enough surgical caseload to enable their case outcomes to be examined tend to cause fewer than average very expensive cases.

The analysis of surgeons' postoperative billing practices examined whether surgeons routinely billed for postoperative services and how those billing practices varied by the policies of the carrier, and by the surgical procedure or the specialty of the surgeon. This analysis also identified surgeons who typically provided more post-hospital services to assess the potential impact of the standardized 90-day postoperative global fee period implemented as part of the new physician payment system. As part of this analysis we assumed the global fee payment reflected the number of postoperative visits provided on average. We then

determined the percentage of physicians who provided more postoperative visits than the average, and estimated the new policy's impact by considering surgeons with shorter global fee periods but more postoperative visits than average. For total hip replacement, 18 percent of the surgeries in the 10-to-44-day global fee period were performed by surgeons who provided between one and two visits on average across their caseload. For knee replacement, 19 percent provided about two more visits than the average. And for TURP, 12 percent provided about one more visit and 3 percent provided about two more visits on average. These results suggest that relatively few surgeons would not receive adequate reimbursement under the new standardized global fee payment.

Earlier research on assistants at surgery raised concerns about inappropriate billing and inefficient substitution of labor. This analysis of assistants at surgery investigated whether general and family practitioners routinely billed as assistants at surgery for patients who underwent inpatient surgeries and, if so, whether such billing varied depending on the nature of the surgery or the practice. We found that internists and surgeons assisted at surgery for DRGs with a more complicated casemix on average, while general and family practitioners assisted for cases that, on average, were comparable to surgical cases overall. In addition, DRGs for which general surgeons showed high rates of assisting at surgery, showed lower rates for general and family practitioners. On the other hand, DRGs for which general and family practitioners showed the highest rates of billing as assistants at surgery showed comparable rates for general surgeons. However, the rates of billing as assistants at surgery for general and family practitioners were higher in hospitals in rural areas. Finally, after examining individual physician practice patterns, we concluded that, except for surgical subspecialties, the majority of physicians within a specialty never billed as an assistant at surgery and the second largest group of physicians billed as assistants for less than one out of every four surgeries. Only 2.5 percent of the general surgeons billed as assistants at surgery for over 75 percent of their surgeries and, therefore, may have had a specialized practice.

Overall, these analyses faced three limitations. First, since restricting analyses to uniquely identified solo practitioners substantially reduced the sample size and could reflect insurance carriers' administrative policies, each of these analyses used a "physician practice" as the unit of analysis. Although not ideal, we found similar results including only solo practitioners. Second, after exclusions and classifications across several attributes, sample size within some categories became too small for reliable estimates. Third, one cannot reliably measure the practice patterns of physicians with small caseloads. And in the analysis of physicians' role in creating very expensive cases, we found that the practice style

itself was correlated with the size of the caseload. That is, surgeons who had a large enough surgical caseload to examine their outcome tended to cause fewer than average very expensive cases. So findings based on physicians with larger caseloads may not apply to physicians with smaller caseloads.

While improved data collection, the availability of Unique Physician Identification Numbers, and the National Claims History file will enhance future studies of physician practice patterns, the analytic difficulty of studying physicians with small Medicare caseloads remains.

Each of these analyses used the 1986 Part B Medicare Annual Data (BMAD) provider file, a 5 percent sample of physicians. The file contains all the claims for services provided to beneficiaries by this sample of physicians.

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We would like to thank Benson Dutton, the Health Care Financing Administration project leader for this study, for providing support throughout the course of the project. Daniel Byrne also deserves special credit for helping develop many of the data files on which the analyses are based. Susan Marquis provided a very helpful review of an earlier draft of this Note.

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1. INTRODUCTION

Analyses based on a random sample of Medicare beneficiaries must often attribute unexplained variation to physician practice style. A sample of beneficiaries enables control for regional, hospital, and patient characteristics; however, it does not provide information about whether a physician employs a certain practice style across his or her entire Medicare caseload or how much practice varies according to characteristics of the case. For instance, does a physician have an entire caseload with longer than average lengths of stay, or does the length of stay vary with the intensity of the hospitalization and have very little to do with the individual physician? This kind of question is unanswerable with a random sample of beneficiaries because such a sample does not contain a sufficient number of claims for each physician to determine individual practice patterns.

The objective of this study was to demonstrate the usefulness of provider-level analyses to investigate the importance of individual physician practice patterns. Specifically, this study used physician-level analyses to study three areas:

- The role of physicians in costly cases;
- Surgeons' practice of postoperative billing; and
- General and family practitioners' billing as assistants at surgery.

ROLE OF PHYSICIANS IN COSTLY CASES

This analysis determined the extent to which one can identify physicians who frequently care for cases that are very expensive compared with the average case in the same Diagnosis-Related Group (DRG). Very expensive cases may signal a quality-of-care problem, particularly in surgical DRGs. Also, expensive cases are a direct threat to hospitals' financial status under the payment rule used for the prospective payment system (PPS).

If it were true that very expensive cases were concentrated in the practices of a few physicians, then hospitals [or Peer Review Organizations (PROs)] could identify such physicians and use their quality-assurance mechanisms to attempt to prevent future repetitions of the problems. The payoff from this kind of action will be low if the typical reason that physicians have more than their share of costly cases is that they take care of patients with exceptional problems. Thus, the second goal of this analysis was to examine the extent to which the physicians who do have many expensive cases have a caseload with

clinical characteristics typical of expensive cases. If successful, this analysis could be the first step in the construction of a "physician outlier index" not unlike the Health Care Financing Administration's (HCFA) mortality rate index for hospitals.

SURGEONS' POSTOPERATIVE BILLING PRACTICES

This analysis explored surgeons' billing practices for postoperative services across their surgical caseload of Medicare patients. Medicare pays surgeons a global fee that incorporates postoperative care into the payment for the surgical procedure. This policy assumes that surgeons' caseloads have sufficient variety so that a surgeon may receive overpayment for one patient and underpayment for another, but on average the surgeon receives the appropriate reimbursement.

This analysis examined whether surgeons routinely billed for postoperative services and how those billing practices varied by the policies of the carrier, and by the surgical procedure or the specialty of the surgeon. This study also identified surgeons who provided more post-hospital services on average, to assess the potential impact of the standardized 90-day postoperative global fee period implemented as part of the new physician payment reform.

GENERAL AND FAMILY PRACTITIONERS' BILLING AS ASSISTANTS AT SURGERY

A study of assistants at surgery found that 9 percent of physicians' Medicare claims for assisting at surgery were billed by general practitioners, and 8 percent were billed by family practitioners (Trude, 1990). These findings called into question the appropriateness of such claims and the nature of these physicians' practices.

This analysis investigated whether general and family practitioners routinely billed as assistants for their patients who underwent inpatient surgeries, and whether billing as an assistant varied depending on the nature of the surgery or the physician's practice.

DATA SOURCES

Each of these three analyses used the 1986 Part B Medicare Annual Data (BMAD) provider file, a 5-percent sample of physicians. This file contains all the claims for services provided to Medicare beneficiaries by this sample of physicians. In addition, each of these analyses linked the physician claims to hospital claims from the 1986 100-percent Medicare Provider Analysis and Review (MEDPAR) file.

OUTLINE OF NOTE

Section 2 of this Note provides a detailed description of the data used for the three analyses. That section discusses limitations to the use of the BMAD provider file and contrasts it to a 5-percent sample of beneficiaries. Section 3 presents the analysis of costly cases, Section 4 presents the analysis of surgeons' billing of postoperative services, and Section 5 presents the analysis of assistants at surgery. Section 6 concludes this Note with a discussion of the potential for future research in understanding physician practice patterns and how new file development currently under way might enhance this effort.

2. DATA AND METHODOLOGY

In this section, we describe the BMAD provider and MEDPAR files, and the general methodology for using these files to analyze physician practice patterns. We also contrast the BMAD provider file with the BMAD beneficiary file and discuss the limitations of its use.

In this section, we confine our attention to the data sources used in common by all three analyses, and the strategies the three analyses share. We present the specific methodologies and analytic strategies of the three analyses within their separate sections.

DATA SOURCES

The three analyses combined 1986 Medicare claims from two sources: the 5-percent BMAD provider file and the 100-percent MEDPAR file.

BMAD Provider File

As part of their claims processing, insurance carriers annually prepare several files describing physicians' Medicare claims. One of these files, the BMAD beneficiary file, takes a 5-percent sample of beneficiaries and collects all the physicians' claims for services provided to those beneficiaries during that year. Another file, the BMAD provider file, takes a 5-percent sample of physicians and collects all the claims submitted by that sample of physicians over a year.

Both these files, whether a sample of beneficiaries or of physicians, provide similar information, such as the type of service provided, how much Medicare paid for the service, identifiers for the beneficiary and the physician's practice, and the specialty of the physician. However, by having all the Medicare claims for a single physician, we can use the BMAD provider file to determine the physician's practice pattern across an entire Medicare caseload and contrast it with the practices of other physicians in the sample.

MEDPAR File

The MEDPAR file contains inpatient hospital claims that provide such information as length of the hospital stay, charges for the stay, DRG, diagnostic codes, and dates of admission and discharge. The 100-percent MEDPAR file collects all inpatient hospital claims for a given year. Having all the inpatient hospital claims allows linking of information about the hospital stay to each of the physician claims for inpatient services.

GENERAL METHODOLOGY

Building analytic files for the three analyses of physician practice patterns entailed linking the physician claims to hospital-stay records and aggregating information for each physician or physician practice. Although each of the three analyses required the construction of a separate analysis file, and although specific details varied among the analyses, the processes of linking and aggregating information were similar.

Linking Hospital and Physician Claims

The hospital claim provides the date of admission and discharge, and dates of surgeries for surgical patients. The physician claim, on the other hand, does not provide exact dates of service, but rather a "first expense date" and a "last expense date," so that the physician can bill for several repetitive services, such as hospital visits, in a single claim. For example, a physician might provide three hospital visits over the course of a patient's week-long hospitalization. The physician's claim might have the first expense date as the admission date, the last expense date as the discharge date, and bill for three hospital visits within the single claim. Therefore, in this instance we can readily identify inpatient services, but not the exact dates of service.

In addition to the expense dates' possibly covering a span of time, those dates do not necessarily correspond to the dates of service and therefore may only approximate dates on the hospital claim. For example, the dates of the claim for hospital visits may precede the hospital admission or come after the date of discharge. To accommodate such imprecision we link to the hospital stay closest to the expense dates on the physician claim. After linking the claims based on the best match, we excluded cases if the first expense date on the physician claim preceded the hospital admission or followed the discharge by a given time frame. Depending on the requirements of the analyses, this time frame was either 10 or 30 days.

Aggregating Physician Claims

Before the development of the Unique Physician Identification Number (UPIN), the carrier assigned identifiers to physician practices. The carrier might assign an identifier to either an individual physician, a group of physicians, or a clinic. One of the data elements on the physician claim specifies the number of physicians sharing that identifier. Unfortunately, the practice of assigning an identifier to a single physician varied by carrier, and in many cases it was unknown how many physicians used a single identifier. Hence, solo practitioners on the BMAD provider file were not only physicians that had their own practice, but had been identified as such by the carriers that processed their claims.

The importance of a separate identifier for each physician stems from the need to distinguish the services of an individual physician and to aggregate them as the unit of observation. So although a physician belonged to a group practice, we still wanted to aggregate that physician's claims separately from those of the other physicians in the group. The influence of the type and size of the practice, although potentially important for many analyses, should be measured after the practice of each physician has been identified.

Table 2.1 shows the percentage of services by solo practitioners, practices with more than one physician, and practices for which the number of physicians is unknown. Sixty-one percent of services had identifiers associated with a single physician. Table 2.1 also shows this information for each carrier.

Table 2.1

Percentage of Services by Number of Physicians Within a Physician Identifier and by Insurance Carrier

Carrier	Number of Services	Number of Physicians Sharing a Physician Identifier			
		Unknown	1	2–99	100 or more
All carriers	27,072,963	24	61	14	1
00510 AL	463,180	0	76	24	0
00520 AR	303,968	0	33	60	7
00528 LA	342,166	0	37	53	10
00542 CA/Blue	1,278,910	2	44	44	10
00550 CO	267,158	0	100	0	0
00570 DE	44,760	0	41	59	0
00580 Wash DC	261,257	0	40	60	0
00590 FL	1,752,247	0	99	1	0
00621 IL	1,039,956	100	0	0	0
00630 IN	401,878	50	50	0	0
00640 IA	275,920	0	100	0	0
00645 NE	151,873	0	100	0	0
00650 KS/Blue	173,149	56	12	32	0
00660 KY	336,073	0	100	0	0
00690 MD	339,928	79	6	15	0
00700 MA	659,158	100	0	0	0
00710 MI	1,935,443	0	99	1	0
00720 MN	139,946	72	28	0	0
00740 MO/Blue	199,975	0	99	1	0
00751 MT	67,887	87	13	0	0
00780 NH/VT	306,749	100	0	0	0
00801 NY/West	426,015	11	89	0	0
00803 NY/Empire	2,018,157	15	85	0	0
00820 ND/SD	116,433	0	61	39	0
00865 PA	1,599,996	0	49	51	0
00870 RI	153,778	0	100	0	0
00880 SC	274,436	94	0	6	0
00900 TX	1,341,888	0	100	0	0
00910 UT	90,498	25	75	0	0

Table 2.1—continued

Carrier	Number of Services	Number of Physicians Sharing a Physician Identifier			
		Unknown	1	2–99	100 or more
00930 WA	363,531	0	100	0	0
00951 WI	350,385	29	71	0	0
00973 PR	155,104	0	100	0	0
01020 AK	7,491	35	65	0	0
01030 AZ	333,098	45	55	0	0
01120 HI	76,921	59	41	0	0
01290 NV	102,663	53	47	0	0
01360 NM	67,356	32	68	0	0
01370 OK	299,426	18	82	0	0
01380 OR	218,333	31	69	0	0
02050 CA/Occid	1,471,240	0	53	37	10
05130 ID	74,228	0	91	9	0
05440 TN	609,283	0	75	25	0
05530 WY	25,820	0	88	22	0
10071 Railroad	671,003	29	37	34	0
10230 CT	320,499	11	57	32	0
10240 MN	116,171	42	13	45	0
10250 MS	342,165	43	31	26	0
10490 VA	320,941	11	45	44	0
11260 MO/General	549,582	0	47	53	0
13110 GA	559,014	100	0	0	0
13310 NJ	795,664	100	0	0	0
13340 NC	567,857	100	0	0	0
14330 NY/Group	223,918	0	100	0	0
16360 OH	1,397,501	10	90	0	0
16510 WV	204,346	22	78	0	0
21200 ME	86,641	100	0	0	0

SOURCE: Calculated from the 1986 5-percent BMAD provider file.

COMPARISON OF BENEFICIARY AND PHYSICIAN SAMPLES

The BMAD beneficiary sample takes 5 percent of the beneficiaries based on the last two digits of the social security number. This sample is a subset of the sample of beneficiaries taken for the 20-percent MEDPAR file. The 5-percent sample of physicians, on the other hand, is not as clearly defined because the physicians have nonunique identifiers and each carrier must derive its own sample of physicians.

To assess the representativeness of the BMAD provider file, we compared means of patient characteristics between the BMAD provider and beneficiary files.[1] Whereas both samples provided comparable means for patient age, sex, and race, they differed substantially in length of stay and the proportion of claims sampled by region.

[1]For a study of physicians' hospital visits, two comparable files were derived from the BMAD provider and beneficiary files. The two files contain records of inpatient hospital visits for patients in medical DRGs. The comparison is discussed further in Trude (1992).

There are two explanations for differences by region. First, insurance carriers prepared the beneficiary and physician files separately. Then, when HCFA staff further processed those files to detect any errors, they excluded problematic cases. Since the number of problematic cases may differ across carrier for each file, insurance carriers with higher percentages of errors for a particular file become underrepresented. Second, as mentioned earlier, nonunique identifiers and different sampling strategies by each carrier could also result in differences by region.

For the beneficiary file the average length of stay was 7.65 days compared with 8.76 days for the physician file. This difference in length of stay for the two samples probably resulted from the interaction between length of stay and the number of physicians that provide visits during the particular hospitalization. While 6 percent of single-day hospitalizations involved more than one physician, about one-half of hospitalizations lasting two weeks or more had more than one visiting physician. Since a hospitalization with more physicians providing visits had a greater chance of selection into a sample of physicians, and since longer stays are more likely to involve more physicians, the length of stay for the sample based on physician was biased upward and was longer than for the sample based on beneficiaries.

Finally, when using the BMAD provider file, we exclude one carrier that processes the claims for a unique subset of beneficiaries. Traveler's Insurance handles the claims for railroad beneficiaries, and therefore serves a special group of beneficiaries across many states. Since we could not link the physician claims for those beneficiaries back to the rest of the physicians' caseloads, we excluded those claims from the analyses.

3. ROLE OF PHYSICIANS IN COSTLY CASES

We attempted to determine how frequently we could identify individual physicians (or practices) who frequently care for Medicare cases that have very high hospital costs compared with the average Medicare case in the same DRG. Very expensive cases are important for two reasons. First, very expensive cases may signal a quality-of-care problem, particularly in surgical DRGs. Second, expensive cases are a direct threat to hospitals' financial status when the hospital is paid under PPS.

One may group the reasons why physicians have higher than expected numbers of very expensive cases into three categories. First, any physician may, just by chance, receive a higher than expected number of patients who are very expensive to treat. Second, a physician may specialize in treating very difficult patients with clinical characteristics that give them a much higher than average chance of being very expensive. Third, a physician might practice a style of medicine that results in high expenses for patients whom most other doctors would treat less expensively. From a policy point of view, one would like to be able to identify this last group of physicians—a group that could be targeted for educational efforts or other interventions. Because we have no information about the style of medicine the doctor practices, we attempted to identify this group through a process of elimination of doctors whose excess of expensive cases could be explained by either chance or the clinical characteristics of the patients.

We have analyzed cases in six groups of surgical DRGs. We found few physicians who had so many expensive cases that there was a high likelihood that the physician's true rate of expensive patients[1] was higher than the average rate for all cases. Of course, our ability to detect departures from the average depends on the number of cases seen by the individual doctor. In most of the surgical groups we studied, the likelihood of very expensive surgeries is negatively correlated with the number of such surgeries performed on Medicare patients. Thus, the outlier rate among surgeons who perform enough surgeries to allow a test of the hypothesis is lower than in the total population, and there are very few surgeons who perform a substantial number of surgeries that have outlier rates significantly in excess of the population rate. We shall show that the available clinical characteristics do not explain this negative correlation. There is one surgical group that is an exception to this pattern. In

[1]The cases in our data file can be viewed as a sample from a much larger universe of cases that the doctor might have received. Then the true rate for a particular physician is the proportion of the cases in that universe that would be expensive.

that group there is a wide variation in the outlier rate, even among physician identifiers responsible for more than 50 surgeries in a year. Again, little of that variation was explained by patient characteristics.

METHODS

Sample Definition

The six surgical groups are defined based on DRG. The groups and the labels that we will use in the tables are as follows:

- extracranial vascular procedures, DRG 5, Endart.;
- coronary artery bypass graft, DRGs 106 and 107, CABG;
- major joint procedures, DRGs 209 and 471, Major Joint;
- transurethral prostatectomy, DRGs 306, 307, 336, and 337, TURP;
- various cardiothoracic and vascular procedures, DRGs 108, 109, 110, 111, and 112, Misc. Cardiac; and
- bowel procedures, DRGs 148 and 149, Bowel.

Each group was selected either because it contained DRGs with a large number of very high-loss cases or because it contained a very frequent surgical procedure. DRGs 106, 209, 110, 112, and 148 are five of the six surgical DRGs that contain the largest number of cases with hospital costs in excess of a fixed loss beyond the DRG payment.[2] TURP is the single most frequent surgery causing Medicare hospitalizations, and endarterectomy is also very frequent.

As described in Section 2, we attempted to match each record in the 100-percent MEDPAR file with a Part B record from the provider file for a surgery with a suitable Physicians' Current Procedural Terminology (CPT) code and time frame. In this analysis, we used a 30-day window for the time frame.

Overview of Methods

We used logistic regression to estimate the relationship between the probability that a case would exceed the fifth percentile cutoff in adjusted charges and characteristics of the patient and the hospital. We then used the regression to predict the probability that each hospitalization with a surgeon in our matched MEDPAR and Part B file would be very

[2]See Carter and Melnick (1990) for a more complete DRG list. The sixth DRG is DRG 468, "unrelated OR procedures," which we judged too clinically heterogeneous to include in this study.

expensive. We then summed the predictions for all the cases in each surgeon's care to obtain the expected number of very expensive cases that surgeon would care for if his or her practice style were the same as that used with the average case from the MEDPAR sample. We compared the observed number of cases with the expected number of cases, using the binomial distribution to test whether the data are consistent with the hypothesis that the physician's practice is typical.

Definition of Very Expensive Cases

To identify the cutoffs for very expensive cases and to develop the relationship between clinical characteristics and the probability that a case will be very expensive, we used a 20-percent sample of MEDPAR records. The sample was chosen based on beneficiary identifiers and is thus independent of the provider file.

Very expensive cases were defined as those in the highest 5 percent of adjusted hospital charges within each DRG. The charges for each case were adjusted for input prices, using the hospital's wage index and (in Alaska and Hawaii) the cost-of-living adjustment; the price-adjusted charges were multiplied by the hospital's ratio of cost to charges to get the final adjusted charge for each case. The distribution of adjusted charges was used to establish a separate threshold for each DRG.

Controlling for Characteristics of Hospitalization

The characteristics of the patients used in the regression of the probability that a case would be expensive included demographics, source of admission, and variables derived from the diagnostic and procedure codes for the case. The characteristics of the hospital were its teaching program and its disproportionate share burden. The method of maximum likelihood was used to estimate the coefficients. The data to fit the regression came from a 20-percent random sample of Medicare hospitalizations.

Table 3.1 shows the regression results. In three of our six groups, older patients are significantly more likely to be very expensive, and the disabled (those under 65) are more likely to be very expensive than one would estimate solely from their age. In the Bowel Procedures group, the effect of advanced age is negative, and the younger are more likely to be more expensive. The effect of gender is also variable, with men being less likely to be expensive in CABG and more likely to be expensive for Major Joint and Bowel Procedures.

The coefficients for the source of admission variables show that cases transferred from another short-stay hospital and cases admitted through the emergency room are more likely than other cases to be very expensive, although transfer admissions are statistically significant in only three cases. The source of admission listed on the MEDPAR is known to

Table 3.1

Logistic Regression on the Probability That a Case Is Very Expensive

Variable	Endart.	CABG	Major Joint	TURP	Misc. Cardiac	Bowel
Log (age)	1.53*	2.18*	0.31	3.11*	–0.09	–0.85*
	(0.63)	(0.52)	(0.24)	(0.28)	(0.25)	(0.26)
Indicator age < 65	0.40	0.59*	0.38*	0.54*	–0.09	0.26*
	(0.23)	(0.15)	(0.12)	(0.14)	(0.26)	(0.14)
Male	0.06	–0.36*	0.35*	—	0.01	0.18*
	(0.10)	(0.07)	(0.05)		(0.06)	(0.06)
Transfer	0.15	0.07	0.45	1.19*	0.58*	0.85*
	(0.40)	(0.10)	(0.24)	(0.22)	(0.11)	(0.20)
Emergency-room admission	1.06*	0.34	0.36*	1.04*	0.60*	0.29*
	(0.24)	(0.23)	(0.13)	(0.11)	(0.14)	(0.12)
Emergent admission	0.41*	0.13	0.40*	0.39*	0.26*	0.16
	(0.17)	(0.10)	(0.10)	(0.08)	(0.09)	(0.09)
Interaction	–0.62*	–0.04	–0.26	–0.43*	–0.29*	0.05
	(0.29)	(0.25)	(0.15)	(0.13)	(0.16)	(0.15)
Elective admission	–0.43*	–0.39*	–0.19*	–0.70*	–0.56*	–0.70*
	(0.12)	(0.10)	(0.08)	(0.06)	(0.08)	(0.09)
Teaching adjustment	2.05*	0.93*	2.50*	1.93*	1.04*	1.91*
	(0.47)	(0.29)	(0.23)	(0.25)	(0.23)	(0.28)
Disproportionate share	0.83	0.28*	1.48*	1.60*	1.80*	1.12*
	(0.66)	(0.51)	(0.32)	(0.27)	(0.30)	(0.33)
Prostate cancer	—	—	—	0.37*	—	—
				(0.05)		
Other cancers	—	—	—	0.88*	—	—
				(0.07)		
Procedure 1	—	—	0.13	—	–1.82*	–0.48*
			(0.08)		(0.13)	(0.09)
Procedure 2	—	—	0.44*	—	–1.09*	–0.22
			(0.07)		(0.15)	(0.12)
Procedure 3	—	—	–0.10	—	0.48*	–0.58*
			(0.11)		(0.11)	(0.09)
Procedure 4	—	—	–0.31*	—	0.46*	0.12*
			(0.09)		(0.18)	(0.11)
Procedure 5	—	—	0.22	—	0.01	0.40*
			(0.22)		(0.14)	(0.08)
Procedure 6	—	—	—	—	0.89*	—
					(0.12)	
Procedure 7	—	—	—	—	1.09*	—
					(0.18)	
DRG1	—	–0.15*	0.03	–1.20*	0.67*	0.06
		(0.07)	(0.22)	(0.12)	(0.12)	(0.12)
DRG2	—	—	—	–0.55*	–0.75*	—
				(0.27)	(0.14)	
DRG3	—	—	—	–0.73*	–0.18	—
				(0.09)	(0.11)	—
DRG4	—	—	—	—	0.00	—
					(0.16)	
Sample size	9,707	16,815	34,043	42,405	31,599	27,024
Chi-square	145	136	426	1,519	1,005	664

NOTES: Standard errors are given in parentheses below each coefficient. The procedure variables denote the following ICD-9-CM codes in the order given for Major Joint: 8151, 8159, 8161, 8162, and all others except 8141; for Miscellaneous Cardiac: 360, 3601, 3808, 3844, 3925, 3929, and 3959; and for Bowel: 4573, 4575, 4576, 4579, and 4562. The DRG variables denote in the order given: CABG, 106; for Major Joint: 471; for TURP: 306, 307, and 336; for Miscellaneous Cardiac: 108, 109, 110, and 111; and for Bowel: 149.

*Variable is significant ($p < .05$).

contain many coding errors, which probably bias these coefficients toward 0; thus, better information about the source of admission would probably improve our predictions.

The type of case is classified as either elective, urgent, or emergent. Our model puts in dummy variables for the first and third possibilities, leaving urgent admissions as the comparison category. Elective admissions are less likely than urgent cases to be very expensive—a result that was significant in all six surgical groups. Emergent admissions are more likely than urgent cases to be very expensive. In addition to the dummy variable for an emergent admission, we included an interaction variable that is 1 whenever a case is both from the emergency room and an emergent admission. Its negative sign occurs because the classification of cases that come from the emergency room as emergent is redundant in many hospitals. Putting both emergency-room and emergent admissions into the model allows for variation across hospitals in coding practices for emergency cases.

The factors used to increase operating payments for the indirect costs of medical education and for the hospital's disproportionate share burden have large and significant effects on the probability that a case will be very expensive. The more interns and residents per bed and the higher the disproportionate share percentage are, the more likely it is that a given patient will exceed the adjusted charge percentile.

The remaining variables in the model are derived from the diagnostic and procedure codes for the case, and each surgical group uses a different set of those variables. Men undergoing TURP are much more likely to be very expensive if they have a diagnosis of cancer, although the effect of prostate cancer is a little smaller than the effect of other cancers.

We also included dummy variables that indicated which ICD-9-CM procedure code had caused assignment to the study DRG group. We restricted the specification to codes that occurred in more than 5 percent of patients in the sample. For the TURP and Endarterectomy groups, all or almost all of the cases had the same ICD-9 code. For the CABG group, neither an individual procedure code nor the collection of codes was significantly different from 0; consequently, we dropped those variables from the analyses presented here. The effects of individual procedures were large in each of the remaining three surgical groups. Details of the coding specification are shown in the notes for Table 3.1. For example, in major joint procedures, the default procedure is total knee replacement (8141). Cases with a total hip replacement (8151 or 8159) were more likely than knee replacements to be very expensive; cases with only a femoral head replacement (8162) were less likely than knee replacements to be very expensive.

The final variables in the regression indicate the DRG assignment. Although the cutoffs for the fifth percentile are DRG specific, the DRG still has the ability to help predict very expensive cases because DRGs have different typical values for the other variables in the model.

The last line in Table 3.1 gives the chi-square for the regression as a whole. It has degrees of freedom equal to the number of independent variables in the model—from 10 for the Endarterectomy group to 21 for the Miscellaneous Cardiac group. It is always statistically significant. Although half the predictions fall in the range from 0.061 to 0.026, they cover a wide range from 0.003 to 0.489. Thus there is some chance this clinical model can be used to detect doctors with caseloads that have a much higher than average chance of being expensive, no matter which doctor would care for them.

RESULTS

The ability to identify surgeons who are responsible for a large number of very expensive cases depends on the distribution of number of cases per surgeon. If most Medicare surgeries are performed by surgeons who do only a few surgeries of the same type on Medicare patients, then it will be difficult to identify those physicians it would be effective to target for surgery-specific interventions. This is indeed the case for many types of surgeries. Table 3.2 shows the distribution of cases according to the number of hospitalizations matched to the physician. Over three-quarters of the cases in the Endarterectomy group and Bowel Procedures group were performed by surgeons who performed less than 25 such surgeries.

On the other hand, the sample CABG surgeries are concentrated in a reasonably small number of providers. Over half are performed by surgeons with an identifier responsible for

Table 3.2

Distribution of Cases by Number of Similar Medicare Surgeries Performed, by the Primary Surgeon's Identifier

Clinical Group	Number of Cases	Percentage of Cases in Each Surgery Count Group (%)				
		≤25	26–50	51–75	≥76	Total
Endart.	1,882	76.4	13.3	5.5	4.8	100
CABG	3,429	14.7	11.5	22.5	51.3	100
Major Joint	5,475	56.9	16.7	10.0	16.4	100
TURP	8,211	27.0	39.5	19.0	14.6	100
Misc. Cardiac	8,396	58.7	25.5	5.0	10.8	100
Bowel Procedures	7,447	89.4	7.6	0.9	2.1	100

76 or more cases per year; almost 75 percent are performed by those with 51 or more cases per year.

In Table 3.3 we show how likely it is that a surgeon would experience at least as many very expensive cases as he or she actually had if his/her expected proportion of very expensive cases were equal to the average for his/her clinical group. In the table, surgeons are grouped according to the number of similar Medicare surgeries that they performed each year using the same groups as in Table 3.2. Out of the surgeons who performed 25 or fewer cases, 77.6 percent had no very expensive cases and therefore had a probability of 1 of experiencing at least this number of very expensive cases. We can reject the hypothesis that the surgeon's expected rate is the same as the average at the 5-percent level for only 3.3 percent of the surgeons who performed 25 or fewer cases. It is not until we get to the small number of surgeons with 51 to 75 cases that the distribution of very expensive cases by surgeon suggests that there are nonrandom effects.

We have more than 50 cases per surgeon for almost all CABG cases. Within this group, if a small number of physicians are responsible for many very expensive cases, we should be able to identify them. We also have samples with reasonable power in the Major Joint and TURP groups since over 25 percent of each set of cases is by an identifier with more than 50 cases. Although the concentration is less in the Miscellaneous Cardiac group, the large sample size allows it to maintain some power.

In addition to sample size per surgeon, there is another reason why it is difficult to identify individual surgeons who are responsible for a large number of very expensive cases.

Table 3.3

Distribution of Surgeons by Probability That Doctor Would Have at Least as Many Very Expensive Cases as Observed If the True Probability Were the Average for the Group, by Number of Similar Medicare Surgeries

Probability of Data at Least as Bad as Observed	Percentage of Surgeons by Surgical Cost Group (%)				
	≤25	26–50	51–75	≥76	Total
0–0.05	3.3	4.3	10.3	11.6	3.6
0.05–0.10	3.2	2.4	0.0	0.0	3.0
0.10–0.15	2.2	2.8	3.4	4.7	2.3
0.15–0.20	2.7	1.9	0.0	2.3	2.6
0.20–0.60	9.0	18.0	20.7	18.6	9.8
0.60–0.99	2.0	39.8	43.1	41.9	5.1
1.00	77.6	30.8	22.4	20.9	73.6
Total	100.0	100.0	100.0	100.0	100.0
Number of Surgeons	(3,528)	(211)	(58)	(43)	(3,840)

In four of our six surgical groups, the probability that a case will be very expensive is negatively correlated with the number of cases performed by the surgeon. Table 3.4 shows the data for each surgical group divided into quartiles based on the number of cases per physician. For example, of the 25 percent of cases with the fewest cases per surgeon in the Endarterectomy group, 6.1 percent are very expensive whereas only 2.6 percent of the cases in the highest quartile of cases per surgeon are very expensive. A similar pattern of decline with an increase in number of cases per surgeon is found in the CABG, Miscellaneous Cardiac, and Bowel Procedure groups. This decline in the rate of very expensive cases as the number of cases per surgeon increases greatly reduces the proportion of very expensive cases that are performed by surgeons with a high caseload.

Table 3.5 shows that the negative relationship between number of cases per surgeon and very expensive cases remains true after we control for clinical characteristics of the patients. The clinical severity indicator used in the table is the logarithm of the prediction that a case will be very expensive from the regressions in Table 3.1. Note that in every surgical group the coefficient on the severity measure is close to 1—usually differing by less than a single standard deviation. This suggests that the sample drawn independently from the MEDPAR file provided a relationship between clinical characteristics and the probability that a case would be very expensive, a relationship that is replicated in this sample. After we control for clinical characteristics, the effect of the number of cases per surgeon remains significant and negative in the same four surgical groups as shown in Table 3.4. No statistical relationship between number of cases and very expensive cases is found in the Major Joint or TURP surgical groups.

Table 3.4

Percentage of Very Expensive Cases, by Number of Annual Medicare Cases Performed by the Surgeon, Divided into Case Quartiles

Clinical Group	Actual			
	Lowest Quartile	Middle Quartiles	Highest Quartile	Total
Endart.	6.1	4.0	2.6	4.1
CABG	5.4	2.3	2.2	3.0
Major Joint	7.3	4.9	8.1	6.3
TURP	5.8	4.3	7.1	5.3
Misc. Cardiac	9.9	6.2	5.1	6.8
Bowel Procedure	4.9	4.1	3.1	4.1

NOTE: A chi-square test rejects the hypothesis of independence in each of the surgical groups ($p < .05$).

Table 3.5

Logistic Regression on Probability of a Very Expensive Case as a Function of Number of Cases Performed by the Surgeon and Severity Measure

Clinical Group	Coefficient			Chi-Square
	Intercept	Log of No. of Cases	Log Severity	
Endart.	0.581	–0.209*	1.064*	29.0*
	(0.698)	(0.106)	(0.225)	
CABG	0.344	–0.312*	0.839*	26.2*
	(0.831)	(0.085)	(0.263)	
Major Joint	0.807	–0.072	1.103*	107.4*
	(0.354)	(0.047)	(0.11)	
TURP	0.251	0.070	1.120*	371.8*
	(0.284)	(0.064)	(0.062)	
Misc. Cardiac	0.454	–0.160*	0.882*	267.9*
	(0.185)	(0.035)	(0.062)	
Bowel Procedures	0.213	–0.131*	0.996*	142.8*
	(0.284)	(0.060)	(0.89)	

NOTE: Standard errors in parentheses. See Table 3.2 for sample sizes. All chi-squares have 2 degrees of freedom.

*$p < .05$.

It remains only to determine how many surgeons, if any, have more than the expected number of very expensive cases and are unlikely to have a true rate equal to the average. We need to decide on a significance level for the event "their true rate equals the average." We have 3,839 surgeons in our sample, so if we take a high level—say, 0.05—we would include a large number of surgeons whose expected value is really at the average. Consequently, we have chosen 0.001 as our significance level. We would expect no more than four surgeons to be included at this level just by chance.

Table 3.6 contains a line for each identifier for which the probability is less than or equal to 0.001 that at least the observed number of very expensive cases would occur if the physician's true rate were average for the surgical group. The selection was made before controlling for clinical characteristics. There were 18 identifiers that met the 0.001 significance level, much more than the four that would be expected statistically if all physicians were equal. Consistent with our previous findings, the highest proportion of physicians was selected in the TURP group (7 out of 344) and the next highest in the Major Joint group (5 out of 524). We also selected 5 out of 1,162 physicians in the Miscellaneous Cardiac group, but only one out of the 1,414 physicians in the Bowel group and none in the other two groups, which are each much smaller (111 physicians in the CABG sample and 284 physicians in the Endarterectomy sample).

Table 3.6

Description of Surgical Practices with High Likelihood That Rate of Expensive Cases Is Higher than Average

Group	Number of Cases		Percentage Expensive (%)		Significance Level
	Total	Expensive	Actual	Predicted	
Major Joint	24	7	29.2	4.2	0.00004
Major Joint	15	9	60.0	8.6	<0.00001
Major Joint	56	41	73.2	12.8	<0.00001
Major Joint	6	4	66.7	4.3	0.00005
Major Joint	7	4	57.1	3.2	0.00003
TURP	22	11	50.0	13.6	0.00005
TURP	63	14	22.2	10.8	0.00636
TURP	67	14	20.9	12.6	0.03864
TURP	117	31	26.5	7.3	<0.00001
TURP	6	4	66.7	11.9	0.00242
TURP	119	23	19.3	7.3	0.00002
TURP	86	13	15.1	6.8	0.00552
Misc. Cardiac	17	6	35.3	5.5	0.00020
Misc. Cardiac	53	23	43.4	8.0	<0.00001
Misc. Cardiac	7	4	57.1	5.5	0.00028
Misc. Cardiac	24	8	33.3	4.9	0.00001
Misc. Cardiac	5	4	80.0	8.6	0.00025
Bowel	11	6	54.5	5.0	0.00001

The seven TURP physicians in Table 3.6 accounted for a total of 110 very expensive cases, or 25 percent of the very expensive cases in the sample. Five of these physicians have very large practices. The predicted percentage is calculated by applying the regression from Table 3.1 to the individual cases from each practice. Interestingly enough, these physicians tend to operate on patients who, a priori, are more likely to be very expensive than the 5-percent average in the sample. However, as can be seen from the last column of the table, it is unlikely that this fact alone accounts for these physicians' large number of expensive cases.

In Table 3.6, only one of the physicians performing major joint procedures has a sizable practice in major joint surgery for Medicare patients, but an extraordinary 73.2 percent of his/her cases are very expensive. It turns out that this one physician is solely responsible for the lack of a negative relationship between very expensive cases and the number of surgeries per physician in the Major Joint group. By removing this physician from the sample, the coefficient on sample size becomes negative and significant ($p<0.01$) in the regression in Table 3.5. The set of physicians performing major joint procedures shown in Table 3.6 accounts for 65 very expensive cases, or 19 percent of the very expensive cases in the sample.

In the other four groups we cannot identify physicians responsible for any significant fraction of the very expensive cases. The identified physicians account for only 8 percent of the very expensive cases in the Miscellaneous Cardiac group and a much smaller percentage in the other three groups.

DISCUSSION

We could identify individual physicians who frequently care for a substantial fraction of very expensive cases in only one of our six surgical groups (TURP). In addition, a small number of physicians account for 19 percent of the very expensive cases in the Major Joint sample. The generalizability of this latter result is seriously in doubt because it depends so heavily on one particular physician identifier. In the other four groups, we could not identify physicians responsible for any significant fraction of the very expensive cases.

There are two reasons why we could not achieve our original goal. First, many surgeons operate on only a small number of Medicare patients in any set of DRGs with clinically similar surgeries. Thus, in most DRGs, a very large fraction of surgeons have so few cases that any outcome is consistent with chance.

Second, in many DRGs, there is a negative correlation between the likelihood of a very expensive case and the number of surgeries that are performed by the surgeon. Therefore, surgeons that have a large enough case load that one can examine their outcome tend to cause fewer than average very expensive cases. This result is analogous to other findings in the literature. A large body of research has established an association between better patient outcomes and higher annual hospital volumes of patients undergoing specific procedures or admitted for certain diagnoses. Luft, Garnick, Mark, and McPhee (1990) reviewed 25 studies of volume–outcome relationships and reported that findings are consistent across studies that employ a range of different model specifications, methodological approaches, and data sets. Compared with the large body of research on hospital volume, the evidence on the relationship between physician volume and patient outcomes is more limited because physician volume data are more difficult to obtain. However, Hannan et al. (1989) showed that physician volume was significantly and negatively related to mortality for a variety of procedures, including coronary artery bypass graft surgery. Therefore, this analysis supplements these studies by finding that physician volume is also significantly and negatively related to the likelihood that a case will be very expensive.

The concept of using profiling to assess individual physician performance has received much attention recently (e.g., PPRC, 1992). Profiling compares outcome rates of individual

physicians with standards developed from either statistical descriptions of average outcome rates or from practice guidelines. The ability of such a system to produce large cost reductions is limited by the extent to which it can identify physicians as having unusual profiles due to physician behavior rather than due to chance. However, the combination of a small number of similar surgeries per physician and a negative correlation between number of surgeries performed by a physician and the likelihood of a very expensive case suggests that most cases with atypical costs cannot be statistically linked to provider behavior rather than chance.

4. SURGEONS' POSTOPERATIVE BILLING PRACTICES

The HCFA implemented a national standard for global surgery fees as part of the new physician payment reform, which began in January 1992. This new national global surgery fee provides a single payment for each major surgery and covers all preoperative visits beginning the day before the surgery, intraoperative services, and all services for 90 days following the surgery.[1]

Global fee packages are not new; however, a standardized definition for such packages is. Prior to the new payment system, insurance carriers defined the packages and often varied the package according to the procedure. For instance, whereas one carrier included all services occurring 30 days after a transurethral resection of the prostate, or TURP, another included all services occurring 90 days after the surgery. Hence, definitions of preoperative, intraoperative, and postoperative care varied depending on the surgery and the insurance carrier. Carriers also had differing policies for payment for re-operation and complications.

Harrow and Mitchell (1991) give two justifications for a standardized global fee definition. First, since the national resource-based fee schedule has values for surgeries based on a standard set of preoperative and postoperative services, equity of payment requires a consistent set of global fee definitions that reflect the fee schedule. Second, without a consistent set of global fee definitions, physicians might submit extra bills for services related to the surgery to offset any losses in revenue from the new fee schedule.

But comments to the HCFA concerning the final rule (DHHS, 1991) warn that some patients require an extraordinary amount of postoperative care. In such instances a surgeon is not paid for the extra care. In its reply, the HCFA notes that some patients need less than the usual amount of care, and in such instances a surgeon would receive overpayment. The HCFA assumes that these differing types of patients balance out across a surgeon's caseload, and that surgeons receive the appropriate reimbursement on average.

However, if some surgeons have more complex and complicated caseloads than average, the standard national global fee policy might not adequately reimburse them. But it should also be noted that the unstandardized global fee packages may not have adequately reimbursed those surgeons either.

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[1]Special modifiers identify services not normally included within the global fee, and special allowances are made for re-operations and complications.

In an analysis of a survey of surgeons' billing practices, Rosenbach (1988) found that the number of post-hospital follow-up visits varied by specialty, but that at least 75 percent of the surgeons included all post-hospital office visits in the global fee regardless of their specialty and the surgical procedure. The average number of those visits did vary by specialty, and Rosenbach notes that some of the variations may stem from differing patterns of use of concurrent care by surgical subspecialties.

Rosenbach's (1988) analysis uses information from the Physicians' Practice Follow-up Survey, which asked for the number of post-hospital office visits the physician typically provides. Our analysis complements that earlier research by using physician claims to determine surgeons' actual billing practices for postoperative services across their entire caseload. Specifically, this study examines whether some physicians routinely bill for postoperative services and how such billing practices vary by the policies of the carrier and by the surgical procedure or specialty of the surgeon. Then, this study identifies physicians who provide more post-hospital visits on average and contrasts different global fee periods to assess the potential effect of the new standardized global fee period.

METHODS

This analysis consolidated information about a major surgery with the number of postoperative services provided by the primary surgeon and the carrier's global fee period and policy for that major surgery. To explain the construction of this analysis file, we first describe the data sources and then the aggregation and linking of those data sources. Then we discuss the analytic strategy and the reasoning behind it.

The data sources for this analysis included (1) the 1986 BMAD provider file, (2) the 1986 100-percent MEDPAR file, and (3) HCFA's Bureau of Program Operations (BPO) Carrier Survey for global fee policies. In this survey, the BPO obtained carriers' global fee policies and the postoperative global fee period for each procedure.

We began the analysis file construction by determining the most frequently performed (top) surgical procedures identified from the hospital claims. We eliminated diagnostic tests and all other nonsurgical procedures. The list of top surgical procedures included the following:

- transurethral prostatectomy
- cholecystectomy
- unilateral repair of inguinal hernia
- bypass anastomosis for heart revascularization
- insertion of cardiac pacemaker

- total hip replacement
- arthroplasty of knee or ankle
- amputation of lower limb.

Next, we linked the physician claims in the 5-percent BMAD physician file to the hospital claims for these selected surgeries. For this step, we excluded denied claims and irrelevant providers, such as suppliers and ambulance services. Since the physician claims provide only a 5-percent sample of physicians, many hospitalizations found no match with this file. However, since this linkage did not identify the primary surgeon, there were also many extraneous links to other providers, such as to general practitioners providing care concurrently or to assistants at surgery.

To identify the primary surgeon and the major surgery to which the global fee applied, we used such information on the physician's claim as the CPT code, the code's modifiers, the type of service, and the dates of service. For each of the eight ICD-9-CM procedure codes selected for the analysis, we developed a list of equivalent CPT codes, shown in Table 4.1. As the table indicates, surgical procedures identified in the hospital claims by the ICD-9-CM procedure code may have had several applicable CPT codes, although in some instances a single CPT code accounted for the majority of the surgeries.

Table 4.1

Surgical Procedures

ICD-9-CM Procedure	Number of Surgeries	CPT Codes
Transurethral prostatectomy (60.2)	8,054	52601,[a] 52612, 52614, 52650
Cholecystectomy (51.2)	4,749	47600, 47605, 47610, 47620
Unilateral repair of inguinal hernia (53.0)	3,133	49505,[a] 49510, 49515, 49520, 49525, 49530, 49535
Bypass anastomosis for heart revascularization (36.1)	2,775	33504, 33510, 33511, 33512, 33513, 33514, 33516, 33525, 33528, 33570, 33575
Insertion of cardiac pacemaker (37.7)	2,194	33200, 33201, 33206, 33207, 33208
Total hip replacement (81.5)	2,047	27130,[a] 27131, 27132, 27134, 27135
Arthroplasty of knee or ankle (81.4)	1,937	27440, 27441, 27442, 27443, 27444, 27445, 27446, 27447,[a] 27487, 27700, 27702, 27703
Amputation of lower limb (84.1)	1,409	27590, 27591, 27592, 27594, 27596, 27598, 27880, 27881, 27882, 27884, 27886, 27888, 27889

[a]The CPT code within the ICD-9-CM that accounts for the majority of surgeries.

We identified the primary surgeon by finding the physician who billed the CPT code associated with the surgery; we excluded surgeons serving as assistants at surgery or providing a second surgical opinion. To avoid possible biases in our counts of postoperative visits, we also excluded surgeries if the physician's date of service exceeded the hospital claim's date of surgery by 10 days or if the patient died during the hospitalization.

Next, we aggregated all the claims billed by the primary surgeon for that beneficiary onto a single record, noting whether the service was provided before, during, or after the day of surgery.[2] To calculate when the physician provided the service and the time since the date of surgery, we used the date of surgery reported by the physician for the major surgery rather than the date on the hospital claim.

After this aggregation, we could determine how many services the physician provided within a given period. But the number of bills we observed for a physician should depend on the carrier's global fee period. And the carriers had varying periods covering all postoperative services and postoperative outpatient services. So, the final step linked the outpatient global fee period and the total global fee period for each carrier and procedure.

For the analyses, we calculated both the proportion of a physician's caseload for which the physician billed at least a single postoperative service and the average number of postoperative services the physician billed per surgery. For this step we aggregated across the provider identifier on each claim, and hence the analyses actually pertained to physician practices rather than to individual providers.[3] We excluded surgeries billed to the carrier for railroad retirees (Carrier 10071), since this carrier processes claims for a unique subset of beneficiaries nationally and would not have claims for a physician's entire caseload. Also, after aggregating across the physician's caseload, we excluded surgeons with less than five surgeries.

RESULTS AND DISCUSSION

The HCFA's assertion that the global fee payment will sometimes overpay and sometimes underpay for the services that accompany a major surgery assumes variation within physicians' caseloads. By determining the percentage of physicians who billed at least one postoperative visit for each surgery, we can examine the amount of variation in billing for these visits within a physician's practice.

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[2]There were 112 instances of claims that combined preoperative and postoperative services because the first and last expense dates spanned the date of surgery. Since we used the first expense date to categorize the services, the services for those claims were counted as preoperative visits.

[3]We excluded surgeons in multispecialty group practices, and ran separate analyses including only solo practitioners. Analyses using only solo practitioners gave similar results.

Figure 4.1 presents the distribution of surgeons according to the proportion of their caseload for which they billed a postoperative visit, for both 90 and 180 days after the surgery.[4] Within a 90-day postoperative period, about 35 percent of surgeons did not bill for services. And less than 10 percent of physicians billed for services for over 80 percent of their cases within the 90-day period. Within the 180-day period the percentage of surgeons who rarely or never billed postoperative services dropped to a little over 20 percent. But the percentage who almost always billed postoperative services remained about the same with the longer postoperative period.

Rosenbach (1988) found that at least 75 percent of physicians surveyed reported never billing for postoperative office visits for a typical patient. Figure 4.2 shows the distribution of surgeons' actually billing for outpatient postoperative services according to the proportion of their caseload for which they billed for any outpatient postoperative visit. It presents the

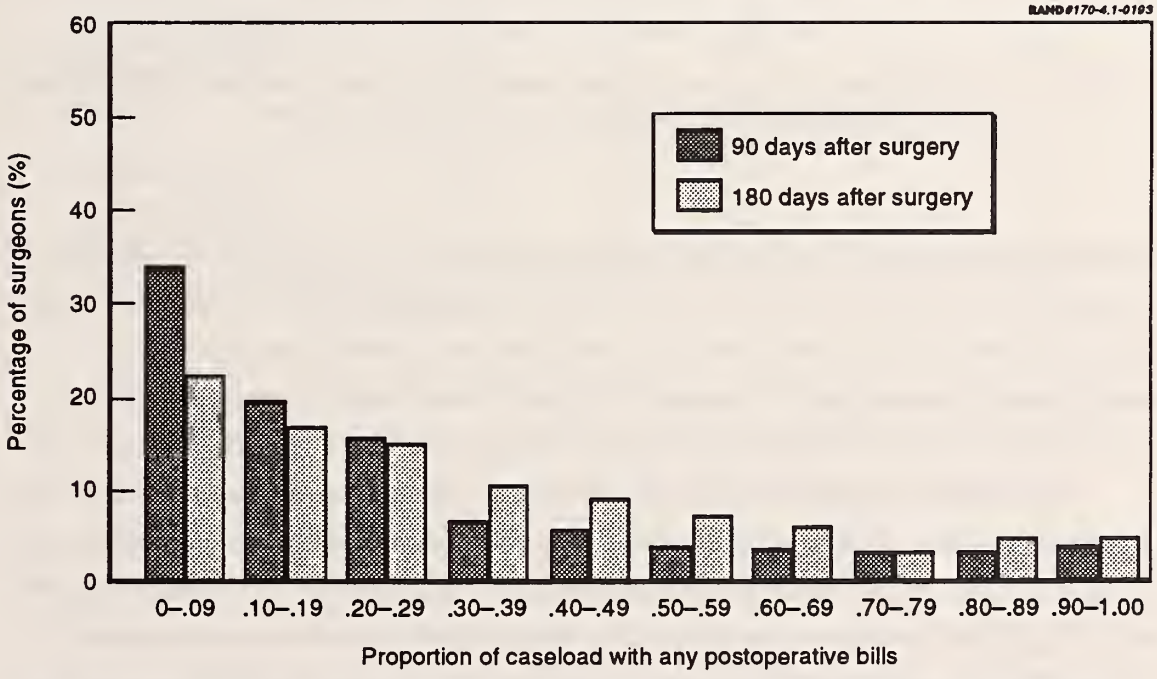

Figure 4.1—Distribution of Surgeons by the Proportion of Their Caseload for Which They Billed for Any Postoperative Services

[4]For the 90-day period, we excluded admissions that occurred in the last three months of the year because these cases may not include all the postoperative bills for the stay. For the 180-day period, we excluded admissions that occurred in the last six months of the year.

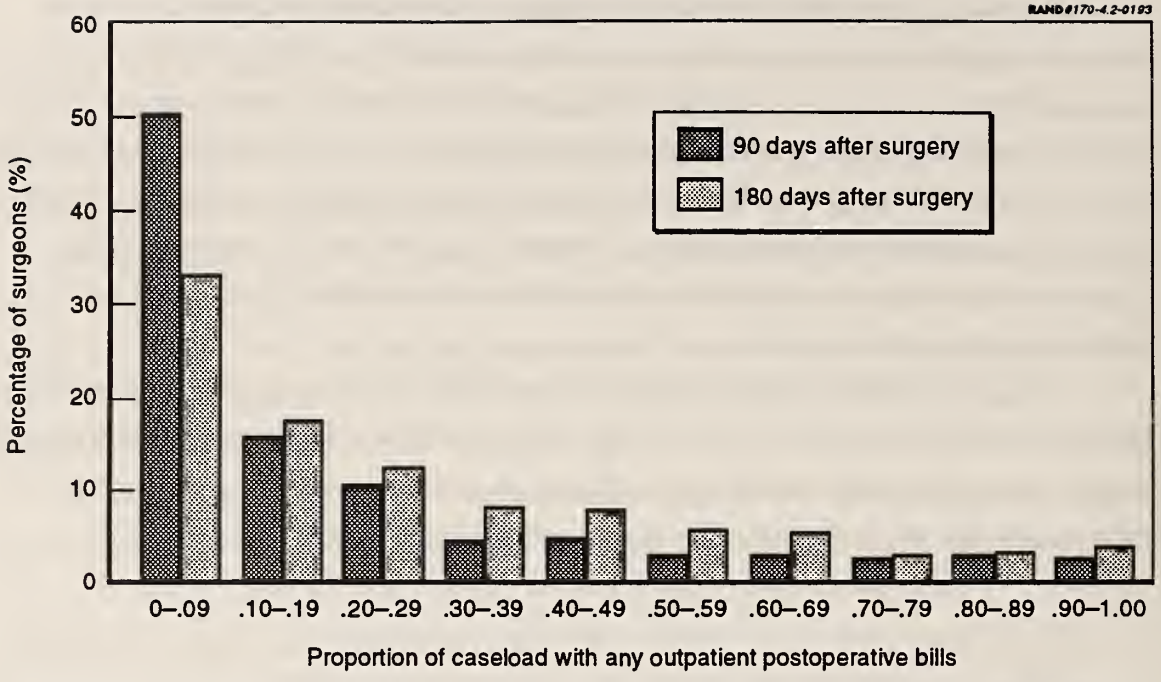

Figure 4.2—Distribution of Surgeons by the Proportion of Their Caseload for Which They Billed for Any Outpatient Postoperative Services

distributions for both a 90- and a 180-day postoperative period.[5] It shows that only about 50 percent of surgeons never billed for postoperative outpatient services within 90 days, and about one-third never did within 180 days. And less than 5 percent always billed for postoperative outpatient services regardless of the follow-up period. So a substantial proportion of surgeons did vary their billing practices across their caseload.

The distributions in Figures 4.1 and 4.2 combine all eight selected surgeries and therefore reflect various surgical procedures, specialties, and carrier policies. Table 4.2 presents the percentage of surgeons by specialty and by the proportion of their caseload for which they billed postoperative services. The table presents the percentages separately for 90- and 180-day postoperative periods and separately for any postoperative billing and outpatient postoperative billing. For example, 80 percent of general surgeons billed at least one or more outpatient services within 90 days of the surgery for less than one-quarter of their caseload. Four percent had such billings for over three-fourths of their caseload.

[5]To count postoperative outpatient visits we excluded stays based on the discharge date rather than the admission date so that the observation period would allow either 90 or 180 days of postoperative outpatient billings.

Table 4.2

Percentage of Surgeons by Specialty and Categories of Caseload

Surgical Specialty	Number of Surgeons	Proportion of Caseload for Which Surgeon Billed Postoperative Services: .00 to .24	.25 to .49	.50 to .74	.75 to 1.00
		Any Bills, 90 Days Post (%)			
General surgery	513	72	17	6	5
Orthopedic surgery	212	61	22	11	6
Thoracic surgery	94	78	12	6	4
Urology	251	53	22	12	13
		Any Outpatient Bills, 90 Days Post (%)			
General surgery	497	80	11	5	4
Orthopedic surgery	205	71	15	8	6
Thoracic surgery	92	84	8	5	3
Urology	251	62	17	10	11
		Any Bills, 180 Days Post (%)			
General surgery	405	60	25	9	5
Orthopedic surgery	150	41	29	17	12
Thoracic surgery	80	72	14	9	5
Urology	239	24	35	24	17
		Any Outpatient Bills, 180 Days Post (%)			
General surgery	390	74	15	7	4
Orthopedic surgery	141	48	26	17	9
Thoracic surgery	78	79	12	4	5
Urology	234	32	33	21	14

SOURCE: 1986 MEDPAR file and BMAD provider file.

While differences between any billings and outpatient billings were not large across each of the specialties, we saw larger differences between a 90-day period and a 180-day period. In particular, the percentage of urologists who did little billing postoperatively dropped in half, from 53 to 24 percent for any bills and from 62 to 32 percent for any outpatient bills.

Again referring to Table 4.2, 13 percent of urologists had postoperative billing for more than three-fourths of their caseload. Therefore, this group might be underpaid on average if the global fee payment did not include sufficient payment for the additional postoperative services.

Table 4.3 presents similar information by surgical procedure rather than the surgeon's specialty. It is not surprising to see that the TURP replicated the results for urologists in Table 4.2. And except for TURP, the other procedures showed similar distributions for a 90-day postoperative period.

Table 4.3

Percentage of Surgeons by Surgical Procedure and Categories of Caseload

Surgical Procedure (CPT)	Number of Surgeons	Proportion of Caseload for Which Surgeon Billed Postoperative Services			
		.00 to .24	.25 to .49	.50 to .74	.75 to 1.00
		Any Bills, 90 Days Post (%)			
Hip replacement (27130)	77	71	14	7	8
Knee replacement (27447)	95	63	16	13	8
Cholecystectomy (47605)	124	79	11	4	6
Inguinal hernia (49505)	101	79	9	6	6
TURP (52601)	253	53	21	12	14
		Any Outpatient Bills, 90 Days Post (%)			
Hip replacement (27130)	75	80	9	4	7
Knee replacement (27447)	86	69	17	6	8
Cholecystectomy (47605)	122	87	4	5	4
Inguinal hernia (49505)	97	81	8	5	6
TURP (52601)	253	62	16	11	11
		Any Bills, 180 Days Post (%)			
Hip replacement (27130)	47	62	25	2	11
Knee replacement (27447)	49	37	39	6	18
Cholecystectomy (47605)	73	67	22	7	4
Inguinal hernia (49505)	57	72	12	5	11
TURP (52601)	240	25	33	24	18
		Any Outpatient Bills, 180 Days Post (%)			
Hip replacement (27130)	43	70	16	5	9
Knee replacement (27447)	46	50	26	9	15
Cholecystectomy (47605)	70	84	9	3	4
Inguinal hernia (49505)	57	77	7	5	11
TURP (52601)	235	32	33	21	14

SOURCE: 1986 MEDPAR file and BMAD provider file.

Rosenbach (1988) found that 87 percent of urologists reported including all postoperative office visits in the global fee for a typical TURP patient, while 8 percent sometimes and 5 percent never included them in the global fee. Again the results in Table 4.3 show that actual billing patterns diverged from reports about a typical patient.

Since carrier policies and global fee periods varied by procedure, a distribution of surgeons performing a particular procedure comprised surgeons with varying lengths of postoperative periods included within the global fee. So, physicians who always billed postoperative visits may have billed to carriers with shorter postoperative periods, whereas those who rarely billed may have had longer postoperative periods.

In Table 4.4, the percentage of surgeons is presented by the length of the postoperative period included in the global fee and the proportion of the surgeries for which the surgeon

Table 4.4

Percentage of Surgeons by Global Fee Period and Categories of Caseload

Outpatient Global Fee Period	Number of Surgeons	Proportion of Caseload for Which Surgeon Billed Postoperative Services			
		.00 to .24	.25 to .49	.50 to .74	.75 to 1.00
		Any Bills, 90 Days Post (%)			
10 to 44 days	207	55	25	10	10
45 to 90 days	128	75	19	5	1
90 or more days	137	63	18	9	10
		Any Outpatient Bills, 90 Days Post (%)			
10 to 44 days	200	64	19	9	8
45 to 90 days	126	85	11	3	1
90 or more days	133	73	14	5	8
		Any Bills, 180 Days Post (%)			
10 to 44 days	164	46	23	19	12
45 to 90 days	99	64	23	11	2
90 or more days	104	39	29	19	13
		Any Outpatient Bills, 180 Days Post (%)			
10 to 44 days	160	58	17	16	9
45 to 90 days	95	73	21	5	1
90 or more days	99	49	28	12	11

SOURCE: 1986 MEDPAR file and BMAD provider file.

billed postoperative visits. For the surgeons with global fees covering 10 to 44 days postoperatively, 55 percent rarely billed for postoperative services and 10 percent usually billed. As expected, for a longer global fee period of 45 to 90 days, 75 percent of surgeons rarely billed for postoperative services and only 1 percent usually did. However, surgeons with global fee periods longer than the 90-day follow-up period exhibited a distribution similar to that of surgeons with shorter follow-up periods, although we expected significantly fewer visits for this group. And this pattern persisted regardless of the length of the follow-up period and the exclusion of inpatient services.

Harrow and Mitchell (1991), using 1988 physician claims for a 5-percent sample of beneficiaries, calculated the average number of postoperative visits provided by surgeons' groupings of procedures and using a 90-day postoperative period. They also contrasted these averages across eight categories of global fee periods not exceeding 90 days. Harrow and Mitchell expected carriers with shorter global fee periods to have more postoperative visits than carriers with longer global fee periods. However, across the surgical groupings in their analysis, they did not consistently find that relationship.

Carriers with longer global fee periods may have allowed more exceptions or may have had operations that differed from the stated policy. Therefore, the 10 percent of surgeons

usually billing postoperative visits may have had more complex caseloads that almost always required exceptions to the global fee policy. Alternatively, some surgeons may have submitted bills for all postoperative visits and left it to the carrier to deny claims within the postoperative global fee period. In some cases, carriers may have allowed some of the claims although they fell within the stated global fee period. Finally, given the sample size, this 10 percent of surgeons may not have been representative.

Under the new, standardized 90-day global fee period implemented as part of the physician payment reform, surgeons with the 10-to-44-day period would now have their postoperative visits covered by the new global fee payment. As stated earlier, this policy might adversely affect surgeons serving a more complex caseload requiring more care on average. That is, surgeons who on average provide more postoperative visits may not receive adequate reimbursement from a global fee.

To identify such a possibility, we wanted to know the percentage of physicians who provided more postoperative visits than the average, which would presumably be the basis for the global fee payment. And we could estimate the impact of the new payment considering surgeons with shorter global fee periods but more postoperative visits than the average.

Table 4.5 shows the percentage of surgeons by the average number of postoperative services provided, the global fee period, and the procedure. It includes all postoperative services within 90 days after the surgery. For total hip replacement with global fee periods of 10 to 44 days, 18 percent of the surgeries were performed by physicians who billed an average of between one and two postoperative services, or about one more visit than the average of 0.30. For knee replacement, also with a global fee period of 10 to 44 days, 19 percent of the surgeries were performed by physicians who billed two to three postoperative services, which is about two more than the average of 0.6. And for TURP, 12 percent of the surgeries were performed by physicians who billed two to three postoperative visits and 3 percent by physicians who billed more than three—at least one visit more than the average of 1.2. So, assuming that the actual number of postoperative visits provided within a global fee payment did not differ radically from the average, these results suggest that relatively few surgeons would not receive adequate reimbursement from the global fee payment. And since the new policy also allows payment for re-operations and complications, the new policy will further minimize any negative impact.

Table 4.5

Percentage of Physicians by Average Number of Postoperative Bills and Global Fee Period

Outpatient Global Fee Period	All Surgeries: Number of Cases	All Surgeries: Mean	Average Number of Postoperative Services per Physician: 0	.01 to 1.00	1.01 to 2.00	2.01 to 3.00	3.01 or more
			Hip Replacement (27130) (%)				
10 to 44 days	82	.30	61	21	18	0	0
45 to 89 days	0	na	na	na	na	na	na
90 or more days	238	.43	23	71	3	0	3
			Knee Replacement (27447) (%)				
10 to 44 days	90	.60	13	68	0	19	0
45 to 89 days	0	na	na	na	na	na	na
90 or more days	297	.41	29	63	8	0	0
			Cholecystectomy (47605) (%)				
10 to 44 days	92	.46	42	52	6	0	0
45 to 89 days	289	.34	48	40	9	0	3
90 or more days	0	na	na	na	na	na	na
			Inguinal Hernia (47505) (%)				
10 to 44 days	288	.26	62	29	7	0	2
45 to 89 days	147	.34	49	43	0	8	0
90 or more days	0	na	na	na	na	na	na
			TURP (52601) (%)				
10 to 44 days	895	1.22	1	54	20	12	3
45 to 89 days	289	.66	0	94	0	6	0
90 or more days	1,276	.93	6	68	11	10	5

SOURCE: 1986 MEDPAR file and BMAD provider file.

NOTE: Values derived based on all postoperative services within 90 days after surgery. Overall mean and percentages are case-weighted; that is, they are based on the number of surgeries rather than the number of physicians.

na indicates not applicable.

5. PHYSICIANS' BILLING AS ASSISTANTS AT SURGERY

The HCFA, in continuing cost-containment efforts, has sought to identify ways to eliminate duplication of payments for services, provide incentives for efficient substitution of labor, and prevent inappropriate billing. For physicians serving as assistants at surgery, in particular, HCFA denies payment when a resident in a teaching hospital could serve as an assistant and for surgeries in which the use of a physician as an assistant occurs relatively infrequently, and HCFA requires prior approval for payment for an assistant at cataract surgery.

An earlier study found that general and family practitioners account for 17 percent of assistant-at-surgery claims to Medicare and 12 percent of the dollars Medicare pays for these services (Trude, 1990). In light of concerns about inappropriate billing and efficient allocation of labor, this study further investigated the use of general and family practitioners as assistants and considered such billings in light of physicians' practices. Specifically, this study investigated whether general and family practitioners routinely billed as assistants at surgery for patients that underwent inpatient surgeries and, if so, whether such billing varied depending on the nature of the surgery or the practice.

This section begins with a description of the data and the underlying methodology for this analysis. The findings of the analysis follow.

METHODS

To describe physicians' practice of billing as assistants at surgery, we constructed a file that allowed us to compare billings by general and family practitioners with billings by surgeons. We included assistant-at-surgery claims submitted to and reimbursed by Medicare. To make the data processing manageable, we restricted our analysis to six specialties: general practice, family practice, internal medicine, general surgery, orthopedic surgery, and thoracic surgery. Also, to discern the specialization of individual physicians, we included only solo practitioners in the analysis.

File Construction

File construction began by extracting all unique beneficiary and physician pairs for the six specialties from the BMAD provider file. We included all patients for whom the physicians had billed Medicare during 1986. We then extracted all the hospital claims from the 100-percent MEDPAR file for each of those patients and linked each hospital claim with the beneficiary and physician pair. Since a beneficiary may have more than one physician

and multiple hospitalizations over a year, we replicated each hospital claim for each beneficiary and physician pair. Finally, we selected only hospitalizations with surgical DRGs.

This file of hospital claims then provided the universe of surgical admissions for each of a physician's patients regardless of whether the physician provided care during that hospitalization. Therefore, when we considered how often a physician served as an assistant at surgery, our denominator was all of the surgical admissions for which the physician might have provided care. We then identified from among all possible surgeries those instances when physicians in the sample billed Medicare as an assistant at surgery.

Using the BMAD provider claims for the six specialties, we extracted all the bills for assistants at surgery. We aggregated those claims to one record for each physician and beneficiary pair, but consolidated multiple billings onto a single record. Therefore, for each physician and beneficiary pair, we retained the date and amount of each billing for services as an assistant at surgery.

Next we linked the information about billing as an assistant at surgery to the file of all possible surgical admissions and determined which billing for an assistant at surgery occurred during that hospital stay.

The final analysis file has 200,878 hospitalizations for 6,071 physicians. Table 5.1 provides, for each specialty, the number of solo practitioners, the average number of surgical admissions per physician, and the average number of instances of billings for assistants at surgery per physician.

Analyses

We calculated how often physicians billed as an assistant at surgery by specialty and determined the rate across all of the inpatient surgical admissions. Other analyses

Table 5.1

Descriptive Statistics by Specialty

Specialty	Number of Physicians	Average Number of Surgical Admissions	Average Number of Bills for Assistants at Surgery
General practice	1,279	24.58	1.42
Family practice	1,253	19.30	1.65
Internal medicine	2,051	38.02	0.18
General surgery	866	44.26	6.82
Orthopedic surgery	477	38.57	3.56
Thoracic surgery	145	72.60	13.11
All specialties	6,071	33.09	2.27

determined the rate at which individual physicians billed as assistants at surgery across their inpatient surgical caseload. For them, we aggregated the number of claims for assistants at surgery for each provider identifier and excluded physicians with less than five inpatient surgeries.

RESULTS

To understand general and family practitioners' billings as assistants at surgery, we first wanted to know how often each specialty bills as an assistant. For any given surgery, a surgical team may or may not have included an assistant at surgery. If a surgery involves an assistant, either a physician's assistant or a physician may serve in that role. This analysis focused on the use of a physician in that role and, specifically, how often the six selected specialties served as an assistant. Table 5.2 shows the results. For example, for all of the surgical admissions for which a general practitioner might have billed as an assistant, 6 percent of those cases had a general practitioner bill as an assistant at surgery.

Since Medicare provides special payments to teaching hospitals through the PPS, the HCFA denies payment for assistants at surgery in teaching hospitals if a resident could provide that service. As Table 5.2 shows, the HCFA allowed very few bills for assistants at surgery for surgical admissions to major teaching hospitals. The proportion of bills for

Table 5.2

Proportion of Surgeries Billed as Assistant at Surgery by Specialty, Teaching Status, and Region

Teaching Status and Region	Specialty					
	General Practice	Family Practice	Internal Medicine	General Surgery	Orthoped. Surgery	Thoracic Surgery
Overall	.06	.09	.00	.15	.09	.18
Major teach	.00	.02	.00	.00	.01	.01
Minor teach	.03	.04	.00	.11	.08	.20
Nonteaching	.09	.12	.01	.19	.11	.20
Nonteaching Hospitals Only						
Urban	.08	.09	.01	.22	.11	.23
Rural	.11	.16	.01	.13	.10	.07
New England	.03	na	.01	.36	.14	na
Mid-Atlantic	.09	.09	.00	.22	.11	.08
S Atlantic	.01	.03	.00	.13	.06	.10
E N Central	.09	.19	.01	.15	.07	.03
E S Central	.03	.02	.01	.18	.04	.08
W N Central	.09	.15	.00	.11	.03	.20
W S Central	.10	.08	.01	.20	.08	.30
Mountain	.12	.24	.02	.20	.18	.18
Pacific	.19	.23	.01	.25	.17	.23

na indicates not applicable.

assistants at surgery increased for minor teaching hospitals, but predominantly for the surgical subspecialties. Presumably, residents in those subspecialties were unavailable or the teaching program did not include those subspecialties. Table 5.2 shows the rate at which the specialties served as assistants at surgery in nonteaching hospitals, which provides the best estimate of the true rate at which physicians served as assistants at surgery without the bias of residents having served as assistants but not having billed for that service.

Table 5.2 also presents the rates at which the six specialties served as assistants at surgery by the urban or rural status of the hospital and the region of the country. These and all the subsequent analyses provide rates for only the nonteaching hospitals.

The rate of billing as an assistant at surgery varied by the specialty and whether the hospital was in an urban or rural area. Family practitioners billed as assistants at surgery more frequently in rural areas, whereas general surgeons and thoracic surgeons had higher rates of billing in urban areas. Since urban hospitals provided more complex surgeries such as coronary bypass operations, which require physicians as assistants at surgery, we expected increased rates of billing in urban areas by surgical specialists. In addition, since rural areas may not have as wide a choice among different types of labor that could serve as assistants at surgery, having fewer qualified physician's assistants or surgical specialists may have led more general and family practitioners to fulfill the role of assistant at surgery for rural hospitals.

An earlier analysis of assistants at surgery used a 1986 sample of beneficiaries and found considerable regional variation in the use of physicians as assistants at surgery (Trude, 1990). The Pacific and Mountain regions showed physicians billing as assistants at surgery more often than in the other regions. This pattern held for general and family practitioners. Internists almost never billed as an assistant, regardless of the region. And while the rates for the surgical subspecialties remained high for the Pacific and Mountain regions, other regions showed a comparable rate of billing by these subspecialties.

Although the overall rate of billing as an assistant at surgery varied across specialty, we expected that the specialties billed as assistants for different types of surgeries. For example, we did not expect general and family practitioners to bill as assistants for a coronary bypass. Table 5.3 shows the DRGs for which general and family practitioners had the highest rates of billing as assistants at surgery. For comparison, it also shows the DRGs for which general surgeons had the highest rates.

We did find very low rates of billing by general and family practitioners for coronary bypass operations. In fact, for the most part, the DRGs for which general surgeons showed high rates showed lower rates of billing by general and family practitioners. On the other

Table 5.3

DRGs with Highest Rates of Billing for Assistants at Surgery, by Specialty

DRG. No.	Specialty and DRG	General Practice	Family Practice	General Surgery
	General Practice			
159	Hernia procs exc inguinal & femoral	.22	.21	.17
197	Total cholecystectomy w/o CDE	.21	.26	.24
358	Uterus & adenexa proc, nonmalig	.20	.21	.28
354	Nonradical hysterectomy	.20	.23	.27
257	Total mastectomy	.19	.28	.21
356	Female repro reconstruct procs	.17	.15	.14
214	Back and neck procs	.17	.06	.27
161	Inguinal & femoral hernia procs	.17	.24	.15
148	Major small & large bowel procs	.17	.26	.25
146	Rectal resection	.17	.23	.24
195	Total cholecystectomy with CDE	.15	.23	.25
	Family Practice			
257	Total mastectomy	.19	.28	.21
164	Appendectomy w compl principal diag	.12	.28	.20
197	Total cholecystectomy w/o CDE	.21	.26	.24
148	Major small & large bowel procs	.17	.26	.25
161	Inguinal & femoral hernia procs	.17	.24	.15
193	Biliary tract proc exc tot cholecy	.08	.24	.25
354	Nonradical hysterectomy	.20	.23	.27
146	Rectal resection	.17	.23	.24
195	Total cholecystectomy with CDE	.15	.23	.25
159	Hernia procs exc inguinal & femoral	.22	.21	.17
358	Uterus & adenexa proc, nonmalig	.20	.21	.28
	General Surgery			
334	Major male pelvic procs	.11	.21	.54
106	Coronary bypass w cardiac cath	.02	.00	.47
110	Major reconst vascular proc w/o pump	.10	.12	.36
107	Coronary bypass w/o cardiac cath	.04	.03	.34
5	Extracranial vascular procs	.12	.17	.33
303	Kidney, ureter & major bladder procs	.10	.09	.33
75	Major chest procedures	.13	.10	.32
358	Uterus & adenexa proc, nonmalig	.20	.21	.28
354	Nonradical hysterectomy	.20	.23	.27
209	Major joint & limb reattach procs	.12	.15	.27
214	Back and neck procs	.17	.06	.27

NOTE: Nonteaching only, case-weighted.
CDE = common-duct exploration.

hand, the DRGs for which general and family practitioners showed the highest rates of billing as assistants at surgery showed comparable rates for general surgeons. This finding suggests a hierarchy of surgeries in which the most complex require surgeons or surgical subspecialties as assistants. But for surgeries of lesser complexity, family and general practitioners may serve as assistants. However, rather than replacing all general surgeons

as assistants for these less complex surgeries, we find that general and family practitioners seem to serve as assistants at about the same rate as general surgeons.

So far, we have considered how physicians as a specialty exhibited different rates of billing as assistants at surgery. But we were also interested in the practices of individual physicians across their surgical caseload. For example, general practitioners who billed as an assistant at surgery for every hospitalized surgical patient may actually have had specialized practices misidentified as general practices. Or those physicians may have billed inappropriately. Also, looking at patterns of individual physicians allows us to determine the variation of practice patterns within the specialty. That is, although family practitioners as a group billed as assistants at surgery for 12 percent of their surgical inpatients, a large percentage of family practitioners may never have billed as an assistant at surgery, and a smaller fraction of family practitioners may have billed regularly. And indeed it would raise concerns about quality of care if all internists served as an assistant at surgery only once out of every 100 surgeries.

Table 5.4 shows the distribution of physicians within each specialty according to the proportion of their surgical caseload for which they billed as an assistant at surgery. For example, about 58 percent of family practitioners never billed as an assistant, and only 1 percent billed as an assistant for more than 75 percent of the surgeries. About 95 percent of internists never billed as an assistant at surgery, and about 4 percent billed for less than one out of every four surgeries. Except for surgical subspecialties, the majority of physicians within a specialty never billed as an assistant at surgery and the second largest group of physicians billed as assistants for less than one out of every four surgeries. Of the general surgeons, 2.5 percent billed as assistants at surgery for over 75 percent of their surgeries and therefore may have had a specialized practice.

The results of Table 5.4 show no evidence for routine inappropriate billing as assistants at surgery. However, we also wanted to determine the range of surgeries for which a general or family practitioner might bill: Billing as an assistant at surgery across a wide variety of surgeries could signal potential quality-of-care problems or inappropriate billing.

We would expect specialists to bill predominantly within a single Major Diagnostic Category (MDC), and would be concerned with physicians billing across many MDCs. If such surgeries are relatively minor and hence do not represent quality problems, they might represent instances for more efficient substitution of labor.

Table 5.5 shows the case-weighted distribution of physicians by the number of different MDCs for which physicians billed as an assistant. Of the surgeries for which an

Table 5.4

Percentage of Physicians by the Proportion of Surgical Caseload for Which They Billed as an Assistant at Surgery

Proportion of Cases Billed as an Assistant at Surgery	Specialty					
	General Practice	Family Practice	Internal Medicine	General Surgery	Orthoped. Surgery	Thoracic Surgery
			Physician-Weighted (%)			
Never	64.3	57.6	94.8	29.6	42.0	47.2
.01 to .24	20.5	23.7	4.4	37.6	45.9	28.1
.25 to .49	9.9	14.5	0.8	22.9	9.9	15.7
.50 to .75	3.8	3.2	0.9	7.4	1.8	9.0
.76 to .99	1.4	1.0	0.0	2.5	0.4	0.0
Always	0.0	0.0	0.0	0.0	0.0	0.0
Number of physicians	625	684	998	476	283	89
			Case-Weighted (%)			
Never	64.6	52.3	92.8	17.0	31.7	20.4
.01 to .24	22.4	26.8	6.4	51.6	55.2	36.6
.25 to .49	7.2	15.9	0.8	21.7	10.7	33.6
.50 to .75	3.0	4.4	0.0	7.8	0.9	9.5
.76 to .99	2.7	0.6	0.0	1.9	1.5	0.0
Always	0.0	0.0	0.0	0.0	0.0	0.0
Number of surgeries	15,370	14,623	39,557	22,607	10,576	4,311

NOTES: Nonteaching hospitals only, case-weighted. Excludes physicians with less than five surgeries.

orthopedist served as an assistant, 78 percent involved a surgeon who served only as an assistant within a single MDC. Of the surgeries for which an internist served as an assistant, 2 percent involved a surgeon assisting across six different MDCs. And for each specialty, only a small percentage of physicians serve as an assistant at surgery across many MDCs.

Again, when we looked at the surgical DRGs for which general and family practitioners most often served as an assistant, we noted that they seemed to be slightly less complicated surgeries than the surgeries for which general surgeons most often assisted. Table 5.6 presents the case-weighted average DRG weight for each specialty's surgical cases overall and for which the physician billed as an assistant. It also presents these averages separately by the proportion of the caseload for which the physician assisted. Whereas internists and surgeons assisted for DRGs with a slightly more complicated casemix on average,[1] the general and family practitioners assisted for cases that on average were comparable with the other surgical cases.

[1]The standard deviation of DRG weight across all surgical cases is 1.16.

Table 5.5

Percentage of Physicians by the Number of Different MDCs for Which They Billed as Assistants at Surgery

Count of MDCs for Which Physician Billed as Assistant	Specialty					
	General Practice	Family Practice	Internal Medicine	General Surgery	Orthoped. Surgery	Thoracic Surgery
1	38.2	33.5	56.8	29.1	77.7	45.1
2	24.3	32.6	22.2	31.6	20.7	22.2
3	21.6	21.7	6.5	22.5	1.6	12.8
4	9.6	9.7	6.5	12.0	0.0	13.3
5	5.5	2.1	6.1	4.2	0.0	3.3
6	0.8	0.4	2.0	0.6	0.0	3.4
Number of bills for assistant at surgery	4,898	5,494	2,355	5,562	2,956	2,916

NOTES: Nonteaching hospitals only, case-weighted. Excludes physicians with less than five surgeries.

Table 5.6

Average Casemix by the Proportion of the Inpatient Surgical Caseload for Which the Physician Billed as an Assistant at Surgery

Proportion of Cases Billed as an Assistant at Surgery	Specialty					
	General Practice	Family Practice	Internal Medicine	General Surgery	Orthoped. Surgery	Thoracic Surgery
			All Surgeries			
Never	1.95	1.91	1.99	1.90	1.85	2.23
.01 to .24	1.80	1.88	1.96	1.99	1.94	2.46
.25 to .49	1.82	1.88	1.98	2.03	1.97	3.11
.50 to .75	1.91	1.90	na	2.16	na	na
.75 to 1.00	1.95	1.89	na	2.02	na	na
Overall	1.91	1.89	1.99	2.00	1.92	2.67
			Physician Billed as Assistant			
.01 to .24	1.94	1.90	2.40	2.27	2.12	2.50
.25 to .49	1.90	1.95	2.11	2.16	2.13	3.76
.50 to .75	1.94	2.05	na	2.25	na	na
.75 to 1.00	1.97	na	na	2.03	na	na
Overall	1.90	1.94	2.35	2.23	2.12	3.10

NOTES: Nonteaching hospitals only, case-weighted. Excludes physicians with less than five surgeries. na indicates not available (too few cases to estimate).

To control for casemix, region, and the urban or rural status of the hospital, we ran case-weighted regression models of the proportion of surgeries for which physicians billed as an assistant. We ran a separate model for each specialty. Table 5.7 presents the coefficients for the DRG weight, rural hospitals relative to urban hospitals, and each census region relative to the East North Central region. Consistent with the findings from Table 5.6,

Table 5.7

Regression of Physicians' Rate of Billing as an Assistant at Surgery, by Specialty

Variable	Specialty				
	General Practice	Family Practice	General Surgery	Orthopedic Surgery	Thoracic Surgery
Case mix	–0.03	0.01	0.12**	0.16**	0.07*
Rural	0.04*	0.08**	–0.06**	0.00	–0.09
New England	0.01	na	0.20	0.05	–0.12
Mid-Atlantic	0.04	–0.08*	0.06	0.07	0.00
S Atlantic	–0.07*	–0.17**	0.05	0.00	0.08
E S Central	–0.06*	–0.16**	0.07*	–0.03	0.04
W N Central	–0.01	–0.05	0.00	–0.04	0.05
W S Central	0.00	–0.09**	0.04	0.00	0.18
Mountain	0.03	0.04	0.03	0.07*	0.11
Pacific	0.06*	0.03	0.08*	0.07**	0.07
R-square for model	0.06	0.18	0.09	0.15	0.30
Number of physicians	668	513	759	292	102

NOTE: Nonteaching hospitals only, case-weighted.

na indicates that there were no family practitioners in the New England region with five or more surgical admissions.

*indicates significance level <0.05.

**indicates significance level <0.01.

surgeons show a higher DRG weight associated with a higher rate of billing as an assistant. General surgeons serve as assistants at a lower rate in rural areas, whereas general and family practitioners serve as assistants at a higher rate in rural areas. Finally, the regional variation persists across specialty, but only general practitioners, general surgeons, and orthopedic surgeons serve as assistants at a higher rate in the Pacific region.[2]

DISCUSSION

That general and family practitioners serve as assistants at surgery at higher rates in rural areas suggests that some of the regional variation may depend on the availability of labor to serve as assistants. Availability may determine whether or not a physician serves as an assistant, as well as the choice of the assistant's specialty.

Unfortunately, Medicare claims can only provide information that a physician has billed as an assistant at surgery and not whether a person of another profession actually served as the assistant. The full range of actual assistants, such as residents and physician's assistants, is not counted.

[2]Ideally, the models would include interaction terms for casemix, rural status, and region, but constraints of sample size preclude this. Rather than serving as a reliable model of physician practice, these models serve only to show that the factors identified earlier are independent effects rather than the result of a single, correlated effect.

Before considering specific new recommendations for payment policy for assistants at surgery, policymakers need a better look into the hospital operating room to see who actually serves as the assistant and how the choice of labor relates to the type of surgery or the availability of labor. Evaluating a range of patterns of use of assistants at surgery across hospitals might provide insights into a more efficient substitution of labor.

6. DISCUSSION

Each of the three analyses in this study used a 5-percent sample of physicians linked to hospitalizations to describe different aspects of physicians' practices and to explore the relevance of individual practice patterns to Medicare policies. Although such linkings proved feasible, the analyses were somewhat constrainted by limitations of the data.

Two limitations of the BMAD provider file have historically created problems for analysis of that file's data. First, the provider identifier may include more than one physician, and in some instances may even represent a clinic. Because insurance carriers processing the physicians' claims have assigned the identifier, the number of physicians represented by a single identifier depends on the administrative policies of each carrier. In studies of physician practice patterns, one ideally wants to uniquely identify the practice style of individual physicians. Two physicians within a single practice with diametrically opposing practice styles might appear average. Therefore, one can either restrict analyses to identifiers associated with a single physician, or one can describe behavioral patterns of "physician practices" rather than of individual physicians. Unfortunately, the former strategy substantially reduces the sample size and the results could reflect the administrative policies of carriers rather than individual physician practice patterns.

For the analyses of surgeons' postoperative billing and assistants at surgery, we adopted both strategies and compared the findings. We found similar results whether restricting the analysis to uniquely identified solo practitioners or using physician practices. However, such results may depend on the analysis, and the findings of our analyses do not guarantee such a fortunate outcome under other circumstances.

The second limitation of the 5-percent BMAD physician sample is sample size. Although that sample provides a large quantity of data, exclusions and numerous classifications quickly result in small counts of physicians within each category. In addition, for studying practice patterns, one cannot obtain accurate estimates for physicians with too small a caseload. Their exclusion further diminishes the total number of physicians in the sample. For example, in the analysis of assistants at surgery, exclusions of teaching hospitals and physicians with fewer than five surgeries, and classifications by specialty and patterns of billing, led to categories with too few cases to accurately estimate the average casemix.

Realizing these limitations and the potential benefit from future analyses of physicians' claims, the HCFA has worked to develop a new data file, the Common Working

File. In addition to streamlining claims processing, this file will provide access to all physicians' claims submitted to Medicare. It also combines differing types of Medicare claims within a single file. For example, a patient with physician office visits, an outpatient hospital surgery, and an inpatient hospitalization would have all claims from each of the physicians providing care, the outpatient hospital record, and the inpatient hospital claim linked within this single file. A file derived from the Common Working File, the National Claims History file, provides the same information but enhances its use for analysis by providing a more manageable record layout.

Also, the HCFA now requires a Unique Physician Identifier Number (UPIN) for each physician billing Medicare. A separate physician file, in addition to maintaining those identifiers, collects such information about each physician as practice location, date of birth, and the board-certified specialty, if available. Aggregations based on this identifier would, therefore, describe an individual physician, but the UPIN would also allow linking of additional information about the physician.

The National Claims History file also provides an additional advantage over the 5-percent BMAD provider file. By collecting all Medicare physician claims, as well as inpatient and outpatient records, one can better understand physician referral patterns. For example, in studies of assistants at surgery, one can aggregate all the claims of surgeons in the 5-percent sample billing as a primary surgeon sometime during the year. Similarly, one can aggregate claims for physicians' billing as assistants at surgery. However, one could not, for instance, look across all the physicians serving as assistants at surgery for a particular primary surgeon. With the National Claims History file such an analysis is feasible and could provide valuable information about efficient substitution of labor.

This study also highlights limitations of studying physician practice patterns, which improved Medicare data collection efforts cannot resolve. Invariably, one cannot reliably measure the practice patterns of physicians who have small Medicare caseloads. And an increase in the total number of physicians in the sample does not alleviate this problem. In the analysis of physicians' roles in very expensive cases, we found that the practice style itself was correlated with the size of the caseload. That is, surgeons with a large enough surgical caseload to examine their outcome tend to cause fewer than average very expensive cases. Therefore, findings based on physicians with larger caseloads may not apply to physicians with smaller caseloads.

The addition of the National Claims History file to the research repertoire will do much to enhance the analyses of physician practice patterns. However, this study has highlighted one particular, remaining drawback.

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